WE CLAIM:

1. A signal receiver comprising:

a primary signal processor comprising a signal input configured to receive an input signal having a first signal dynamic range, an intermediate signal output configured to provide a scaled signal representative of the input signal, a primary variable-gain amplifier coupled to the signal input and the intermediate signal output, and a primary gain controller coupled to the primary amplifier and configured to control a gain applied by the primary amplifier to maintain the scaled signal within a second signal dynamic range; and

a secondary signal processor comprising a signal input coupled to the intermediate signal output, a final signal output configured to provide an output signal representative of the input signal, a secondary variable-gain amplifier coupled to the intermediate signal output and the final output, and a secondary gain controller coupled to the secondary amplifier and configured to control a gain of the secondary amplifier to set the gain of the secondary amplifier to a first gain value when a parameter associated with the scaled signal exceeds a threshold value, and to set the gain of the secondary amplifier to a second gain value different from the first gain value when the signal parameter is less than the threshold value.

2. The signal receiver of claim 1, wherein the primary gain controller comprises:

a power estimator comprising an input coupled to the intermediate signal output and an output configured to provide an indication of one of the signal power or signal amplitude of the scaled signal; and

an inverter comprising an input coupled to the power estimator output and an output coupled to the primary amplifier, and configured to provide a primary gain control value inversely proportional to the signal power or signal amplitude of the scaled signal to control the gain applied by the primary amplifier.

3. The signal receiver of claim 1, wherein the primary gain controller comprises:

an amplitude calculator comprising an input coupled to the intermediate signal output and an output configured to provide an indication of the signal amplitude of the scaled signal; and

a gain calculator comprising an input coupled to the amplitude calculator output and an output coupled to the primary amplifier, and configured to calculate a primary gain control value using the indication of the amplitude of the scaled signal to control the gain applied by the primary amplifier.

4. The signal receiver of claim 3, wherein the gain calculator calculates the primary gain control value using the indication of the amplitude of the scaled signal and an automatic gain control (AGC) algorithm.

5. The signal receiver of claim 3, wherein the primary gain control value is a value of the gain applied by the primary amplifier.

6. The signal receiver of claim 3, wherein:

the primary amplifier is an analog amplifier;

the primary signal processor further comprises an analog to digital converter (ADC) coupled to an output of the primary amplifier and the intermediate signal output, and configured to provide the scaled signal as a digital signal; and

the primary gain controller further comprises a digital to analog converter (DAC) coupled to the gain calculator and the primary amplifier, and configured to convert the primary gain control value from a digital signal to an analog signal.

7. The signal receiver of claim 1, wherein the secondary gain controller comprises a threshold detector configured to determine whether the parameter is above or below the threshold and to set the gain of the secondary amplifier to the first gain value or the second gain value.

8. The signal receiver of claim 3, wherein the secondary gain controller comprises:

a delay stage comprising an input coupled to the gain calculator to receive the primary gain control value and an output, and configured to apply a predetermined time delay to the primary gain control value to provide a delayed primary gain control value at the output; and

a threshold detector comprising a first input coupled to the delay stage output, a second input coupled to the amplitude calculator to receive the indication of the amplitude of the scaled signal, and an output coupled to the secondary amplifier, and configured to calculate the parameter and determine whether the parameter is above or below the threshold and to set the gain of the secondary amplifier to the first gain value or the second gain value.

9. The signal receiver of claim 8, wherein:

the primary signal processor further comprises a signal converter coupled to an output of the primary amplifier and the intermediate signal output; and

the predetermined time delay is substantially equal to a signal propagation delay associated with the signal converter.

10. The signal receiver of claim 9, wherein the signal converter comprises:

a quadrature mixer comprising an input coupled to the output of the primary amplifier and first and second outputs, and configured to provide in-phase (I) and quadrature (Q) components of the scaled signal on its first and second outputs;

first and second filters respectively coupled to the first and second outputs of the quadrature mixer;

first and second analog to digital converters (ADCs) respectively coupled to the first and second filters; and

a digital filter coupled to the first and second ADCs.

11. The signal receiver of claim 10, wherein the amplitude calculator, the gain calculator, the delay stage and the threshold detector are implemented in a digital signal processor (DSP).

12. The signal receiver of claim 11, wherein the secondary amplifier is implemented in the DSP.

13. The signal receiver of claim 8, wherein the parameter is a limiter gain, the limiter gain being inversely proportional to the gain applied by the primary amplifier to generate the scaled signal and the amplitude of the scaled signal.

14. The signal receiver of claim 13, wherein the first gain value is an inverse of the gain applied by the primary amplifier to generate the scaled signal and the second gain value is the limiter gain.

15. The signal receiver of claim 8, wherein the parameter is proportional to the product of the gain applied by the primary amplifier to generate the scaled signal and the amplitude of the scaled signal.

16. The signal receiver of claim 15, wherein the first gain value is a limiter gain, the limiter gain being inversely proportional to the parameter, and the second gain value is an inverse of the gain applied by the primary amplifier to generate the scaled signal.

17. The signal receiver of claim 8, wherein the parameter is a limiter gain, the limiter gain being an inverse of the gain applied by the primary amplifier to generate the scaled signal.

18. The signal receiver of claim 17, wherein the first gain value is unity, and the second gain value is the limiter gain.

19. The signal receiver of claim 1, further comprising an antenna configured to receive communication signals, a first filter stage coupled to the antenna, a frequency converter coupled to the filter stage, and a second filter stage coupled to the frequency converter, an output of the frequency converter coupled to the signal input of the primary signal processor.

20. The signal receiver of claim 1, further comprising receiver components coupled to the final signal output and configured to perform further processing operations on the output signal from the secondary processing stage.

21. A signal receiver comprising:

a primary signal processor comprising a signal input configured to receive an input signal having a first signal dynamic range, an intermediate signal output configured to provide a scaled signal representative of the input signal, a primary variable-gain amplifier coupled to the signal input and the intermediate signal output, and a primary gain controller coupled to the primary amplifier and configured to control a gain applied by the primary amplifier to maintain the scaled signal within a second signal dynamic range;

a secondary signal processor comprising a signal input coupled to the intermediate signal output, a final signal output configured to provide an output signal representative of the input signal, a first secondary variable-gain amplifier having an input coupled to the intermediate output and an output configured to provide a full dynamic range output signal having the first signal dynamic range, a second secondary variable-gain amplifier coupled to the output of the first secondary amplifier and the final output, and a secondary gain

controller coupled to the secondary amplifier and comprising a first gain control output configured to control a gain of the first secondary amplifier to set a gain of the first secondary amplifier to an inverse of the gain of the primary amplifier, and a second gain control output configured to control a gain of the second secondary amplifier to set the gain of the second secondary amplifier to a first gain value when a signal parameter of the scaled signal exceeds a threshold value, and to set the gain of the secondary amplifier to a second gain value different from the first gain value when the signal parameter is less than the threshold value.

22. The signal receiver of claim 21, wherein:

the primary gain controller comprises:

a primary power estimator comprising an input coupled to the intermediate signal output and an output configured to provide an indication of one of the signal power or signal amplitude of the scaled signal; and

a primary inverter comprising an input coupled to the primary power estimator output and an output coupled to the primary amplifier, and configured to provide a primary gain control value inversely proportional to the signal power or signal amplitude of the scaled signal to control the gain applied by the primary amplifier; and

the secondary gain controller comprises:

a first secondary inverter comprising an input coupled to the primary inverter and an output coupled to the first secondary amplifier, and configured to provide the

inverse of the gain of the primary amplifier as the gain of the first secondary amplifier;

a gain estimator comprising an input coupled to the output of the first secondary amplifier and an output configured to provide a gain estimate; and

a threshold detector coupled to the gain estimator and configured to calculate the parameter and determine whether the parameter is above or below the thresold and to set the gain of the second secondary amplifier to the first gain value or the second gain value.

23. The signal receiver of claim 22, wherein:

the gain estimator comprises a secondary power estimator comprising an input coupled to the output of the first secondary amplifier and an output configured to provide an indication of one of the signal power or signal amplitude of the full dynamic range signal;

the parameter is proportional to the signal power or signal amplitude of the full dynamic range signal;

the first gain value is a limiter gain, the limiter gain being inversely proportional to the signal power or signal amplitude of the full dynamic range signal; and

the second gain value is unity.

24. The signal receiver of claim 22, wherein:

the gain estimator comprises:

a secondary power estimator comprising an input coupled to the output of the first secondary amplifier and an output configured to provide an indication of one of the signal power or signal amplitude of the full dynamic range signal; and

a second secondary inverter comprising an input coupled to the power estimator output and an output coupled to the second secondary amplifier, and configured to provide a limiter gain inversely proportional to the signal power or signal amplitude of the full dynamic range signal as the gain estimate;

the parameter is the limiter gain;

the first gain value is unity; and

the second gain value is the limiter gain.

25. The signal receiver of claim 22, wherein:

the primary amplifier and the primary gain controller in the primary signal processor comprise an automatic gain control (AGC) system;

the first secondary amplifier and the first secondary inverter in the secondary signal processor comprise an inverse AGC system; and

the second secondary amplifier and the threshold detector in the secondary signal processor comprise a soft limiter.

26. The signal receiver of claim 22, wherein:

the primary signal processor further comprises a signal converter coupled to an output of the primary amplifier and the intermediate signal output; and

the secondary gain controller further comprises a delay stage coupled to the first secondary inverter and configured to apply a predetermined time delay to a signal at either the input or the output of the first primary inverter, the predetermined time delay being substantially equal to a signal propagation delay associated with the signal converter.

27. The signal receiver of claim 26, wherein the signal converter comprises:

a quadrature mixer comprising an input coupled to the output of the primary amplifier and first and second outputs, and configured to provide in-phase (I) and quadrature (Q) components of the scaled signal on its first and second outputs;

first and second filters respectively coupled to the first and second outputs of the quadrature mixer;

first and second analog to digital converters (ADCs) respectively coupled to the first and second filters; and

a digital filter coupled to the first and second ADCs.

28. The signal receiver of claim 21, wherein the secondary signal processor is implemented in a digital signal processor (DSP).

29. The signal receiver of claim 21, further comprising an antenna configured to receive communication signals, a first filter stage coupled to the antenna, a frequency converter coupled to the filter stage, and a second filter stage coupled to the frequency converter, an output of the frequency converter coupled to the signal input of the primary signal processor.

30. The signal receiver of claim 21, further comprising receiver components coupled to the final signal output and configured to perform further processing operations on the output signal from the secondary processing stage.

31. In a signal receiver, a method for processing a signal, the method comprising the steps of:

receiving an input signal having a first signal dynamic range;

applying a first controlled gain to the input signal to provide a scaled signal representative of the input signal;

controlling the first controlled gain to maintain the scaled signal within a second signal dynamic range;

applying a second controlled gain to the scaled signal to provide an output signal representative of the input signal; and

controlling the second controlled gain to set the second controlled gain to a first gain value when a parameter associated with the scaled signal exceeds a threshold value, and to set the second controlled gain to a second gain value different from the first gain value when the signal parameter is less than the threshold value.

32. The method of claim 31, wherein the step of controlling the first controlled gain comprises the steps of:

estimating one of the signal power or signal amplitude of the scaled signal; and

providing a first gain control value inversely proportional to the signal power or signal amplitude of the scaled signal to control the first controlled gain.

33. The method of claim 32, wherein the step of providing a first gain control value comprises calculating the first gain control value using the signal power or signal amplitude of the scaled signal and an automatic gain control (AGC) algorithm.

34. The method of claim 32, wherein the step of controlling the second controlled gain comprises the steps of:

delaying the first controlled gain by a predetermined time to provide a delayed first controlled gain;

calculating the parameter using the delayed first controlled gain and the signal power or signal amplitude of the scaled signal; and

determining whether the parameter is above or below the threshold.

35. The method of claim 34, further comprising the steps of:

separating the scaled signal into its in-phase (I) and quadrature (Q) signal components;

filtering the I and Q signal components;

converting the I and Q signal components from analog signals to digital signals; and

filtering the digital signals,

wherein the predetermined time is substantially equal to a signal propagation delay associated with the steps of separating, filtering the I and Q signal components, converting and filtering the digital signals.

36. The method of claim 31, wherein the steps of controlling the first controlled gain, applying the second controlled gain, and controlling the second controlled gain are substantially performed in a digital signal processor (DSP).

37. The method of claim 34, wherein:

the parameter is a limiter gain, the limiter gain being inversely proportional to the delayed first controlled gain and the signal power or signal amplitude of the scaled signal;

the first gain value is an inverse of the delayed first controlled gain; and

the second gain value is the limiter gain.

38. The method of claim 34, wherein:

the parameter is proportional to the product of the delayed first controlled gain and the signal power or signal amplitude of the scaled signal;

the first gain value is a limiter gain, the limiter gain being inversely proportional to the parameter; and

the second gain value is an inverse of the delayed first controlled gain.

39. The method of claim 34, wherein:

the parameter is a limiter gain, the limiter gain being an inverse of the first controlled gain;

the first gain value is unity; and

the second gain value is the limiter gain.

40. The method of claim 31, wherein the signal receiver is implemented in a communication device selected from the group consisting of a mobile communication device, a personal digital assistant (PDA), a cellular telephone, a two-way pager, and a wireless modem.

41. The method of claim 31, wherein the step of applying a second controlled gain to the scaled signal comprises the steps of:

applying an inverse of the first controlled gain to the scaled signal to provide a full dynamic range output signal having the first signal dynamic range; and

applying the second controlled gain to the full dynamic range signal.

42. The method of claim 41, wherein the step of controlling the second controlled gain comprises:

estimating one of the signal power and the signal amplitude of the full dynamic range signal; and

calculating the parameter using the signal power or signal amplitude of the full dynamic range signal.

43. The method of claim 42, wherein:

the parameter is proportional to the signal power or signal amplitude of the full dynamic range signal;

the first gain value is a limiter gain, the limiter gain being inversely proportional to the signal power or signal amplitude of the full dynamic range signal; and

the second gain value is unity.

44. The method of claim 42, wherein:

the parameter is the limiter gain;

the first gain value is unity; and

the second gain value is the limiter gain.

45. The method of claim 41, wherein:

the steps of applying a first controlled gain and controlling the first controlled gain comprise an automatic gain control (AGC) method;

the step of applying an inverse of the first controlled gain to the scaled signal comprises an inverse AGC method; and

the steps of applying a second controlled gain and controlling the second controlled gain comprise a soft limiting method.

46. A signal receiver comprising:

means for processing an input signal having a first signal dynamic range to provide a scaled signal representative of the input signal, the first means for processing comprising

means for receiving an input signal, means for amplifying the input signal and means for controlling a gain applied by the means for amplifying to maintain the scaled signal within a second signal dynamic range; and

means for processing the scaled signal to provide an output signal representative of the input signal, the means for processing the scaled signal comprising means for amplifying the scaled signal and means for controlling a gain of the means for amplifying the scaled signal to set the gain of the means for amplifying the scaled signal to a first gain value when a parameter associated with the scaled signal exceeds a threshold value, and to set the gain of the means for amplifying the scaled signal to a second gain value different from the first gain value when the signal parameter is less than the threshold value.

47. A wireless communication device comprising:

a transceiver configured to transmit and receive communication signals; and

a digital signal processor (DSP) operatively coupled to the transceiver, the DSP comprising computer software code for processing a received communication signal having a first dynamic range, by performing the functions of:

applying a first controlled gain to the received communication signal to provide a scaled signal representative of the received signal;

controlling the first controlled gain to maintain the scaled signal within a second signal dynamic range;

applying a second controlled gain to the scaled signal to provide an output signal representative of the received signal; and

controlling the second controlled gain to set the second controlled gain to a first gain value when a parameter associated with the scaled signal exceeds a threshold value, and to set the second controlled gain to a second gain value different from the first gain value when the signal parameter is less than the threshold value.

48. The wireless communication device of claim 47, wherein the device is selected from the group consisting of a mobile communication device, a personal digital assistant (PDA), a cellular telephone, a two-way pager, and a wireless modem.

49. A computer readable medium containing instructions for implementing a method for processing a signal, the method comprising the steps of:

receiving an input signal having a first signal dynamic range;

applying a first controlled gain to the input signal to provide a scaled signal representative of the input signal;

controlling the first controlled gain to maintain the scaled signal within a second signal dynamic range;

applying a second controlled gain to the scaled signal to provide an output signal representative of the input signal; and

controlling the second controlled gain to set the second controlled gain to a first gain value when a parameter associated with the scaled signal exceeds a threshold value, and to set the second controlled gain to a second gain value different from the first gain value when the signal parameter is less than the threshold value.